Data-enhanced Investigations for Climate Change Education (DICCE):

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Gregory G. Leptoukh Online Workshop

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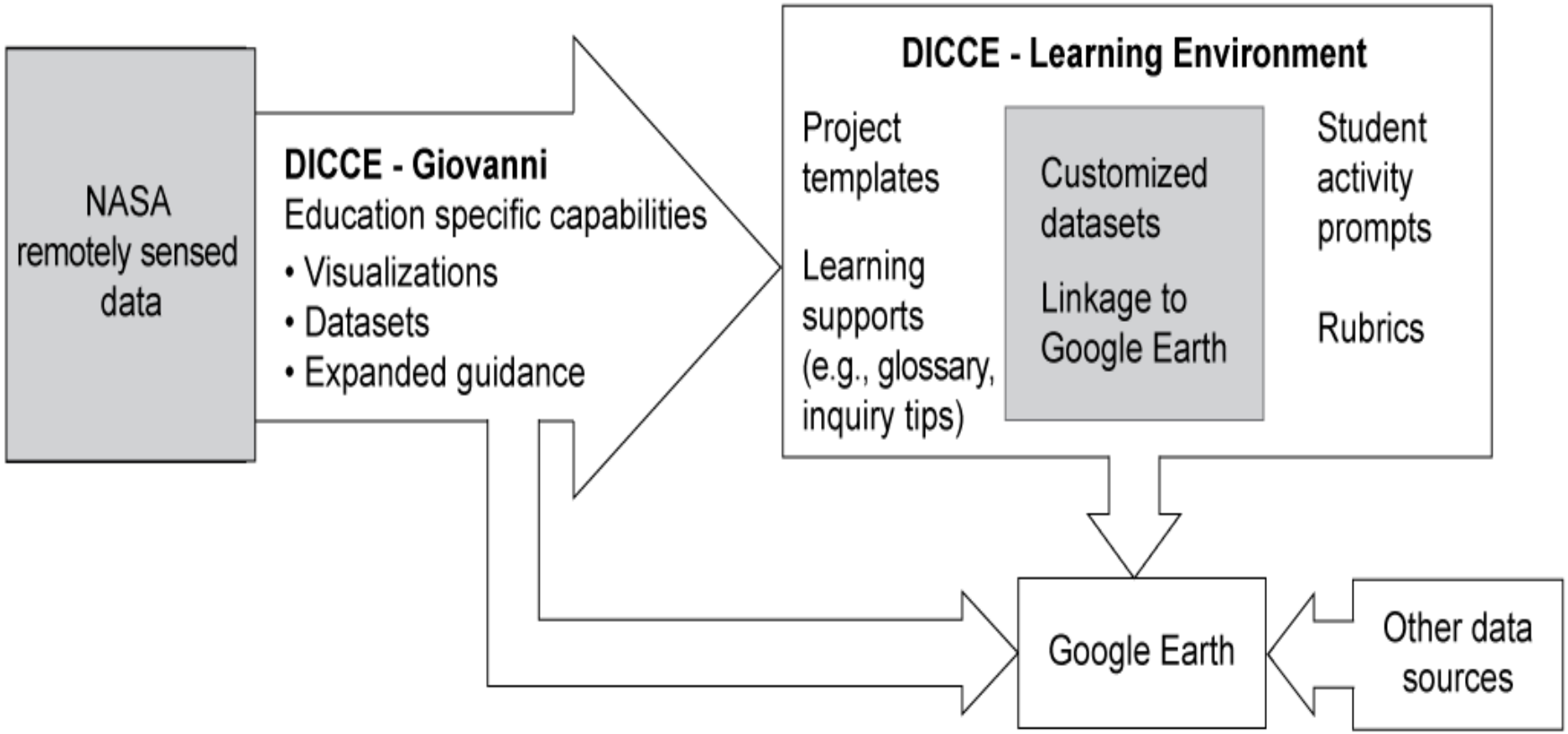
Comprehension challenges

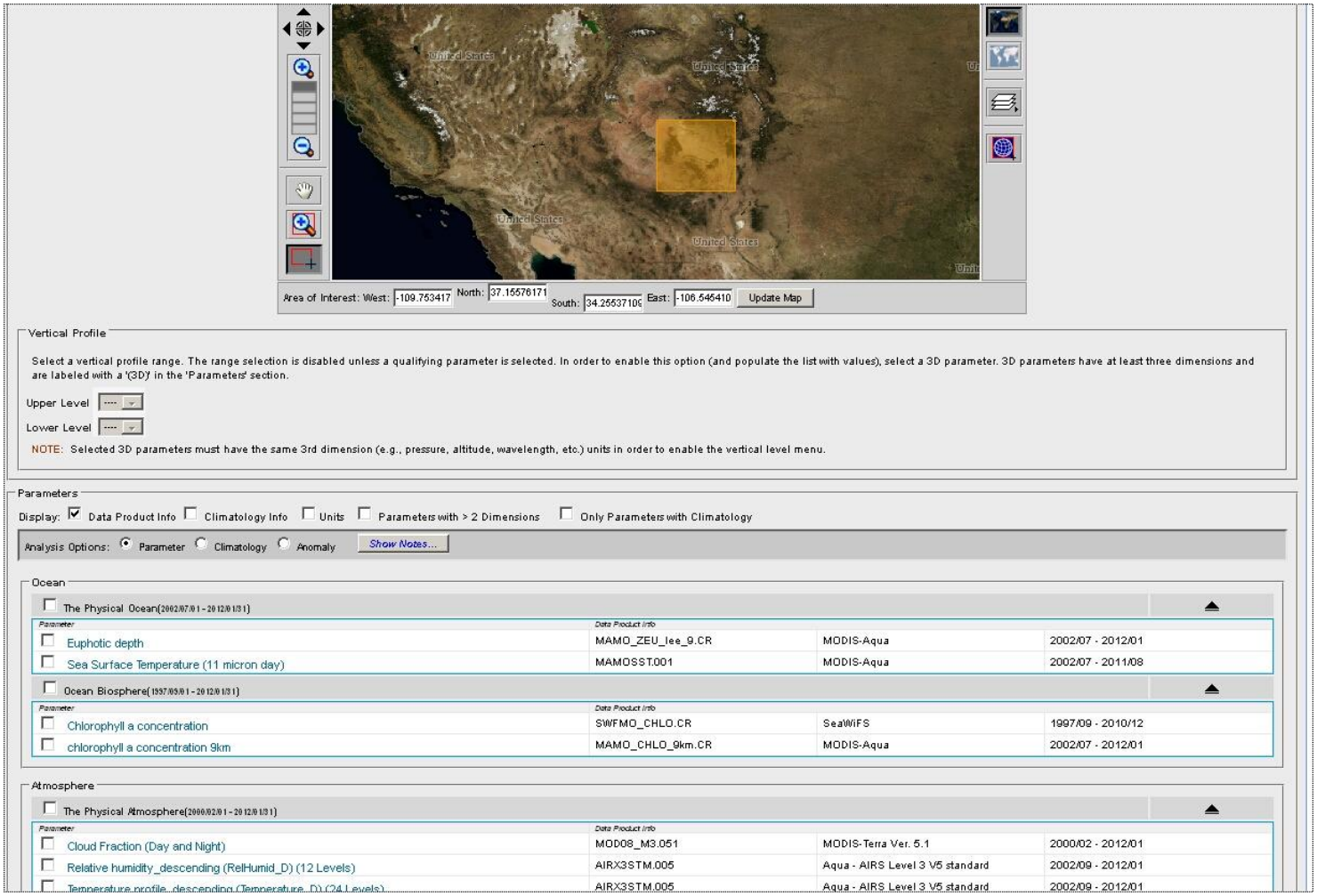
- Technical nomenclature
- Basics of Giovanni visualization i.e., spatial resolution, pallet construction, value ranges)
- Data parameter basics (definitions, significances, metrics)
- Identification of sources (remote-sensing from satellites, data assimilation models, surface readings)

DICCE Structure

Figure 1. DICCE Classroom Project Development Process



DICCE Giovanni (DICCE G) Data Access Tool



Basic monthly data parameters

http://gdata1-ts1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=DICCE-G_Basic

A. Physical Ocean
1. Euphotic depth
2. Sea surface temperature

B. Ocean Biosphere
3. Chlorophyll a concentration

C. Physical Atmosphere
4. Cloud fraction
5. Relative humidity
6. Temperature profile

D. Atmospheric Gases
7. Aerosol optical depth
   CO_2 fraction
8. Deep blue aerosol optical depth
   Mass concentration
9. Total column ozone

E. Precipitation
10. GPCP accumulated precipitation
    GPCP precipitation
11. Observed ground station precipitation
12. Rainfall rate

F. Energy
13. Net longwave radiation
14. Net shortwave radiation
15. Photosynthetically available radiation

G. Physical Land
16. Fractional snow-covered area
17. Land surface temperature (day)
18. Land surface temperature (night)
    Near surface air temperature
19. Near surface wind magnitude
20. Snow depth
21. Snow mass
22. Snowfall rate

H. Land Biosphere
23. Enhanced Vegetation Index
24. Normalized Difference Vegetation Index

Basic daily data parameters

http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=DICCE-G_Daily

A. From Moderate Resolution Imaging Spectro-radiometer (MODIS):
    1. Aerosols
        a. Aerosol optical depth
        b. Deep blue aerosol optical depth
        c. Mass concentration

B. From Atmospheric Infrared Sounder (AIRS)
    1. Gases
        a. CH4 volume mixing ratio ascending
        b. CH4 volume mixing ratio descending
        c. CO volume mixing ratio ascending
        d. CO volume mixing ratio descending
    2. Temperature, Pressure, and Humidity
        a. Outgoing longwave radiation flux ascending
        b. Outgoing longwave radiation flux descending
        c. Relative humidity ascending
        d. Relative humidity descending
        e. Surface air temperature ascending
        f. Surface air temperature descending
        g. Temperature profile ascending
        h. Temperature profile descending

C. From Ozone Measuring Instrument (OMI)
    1. Gases
        a. Ozone Measuring Instrument
        b. Aerosol optical thickness
        c. Column amount ozone
        d. NO2 column
        e. NO2 tropospheric column
        f. SO2 column amount (lower, middle and upper troposphere)

D. From Tropical Rainfall Measuring Mission (TRMM)
    1. Precipitation

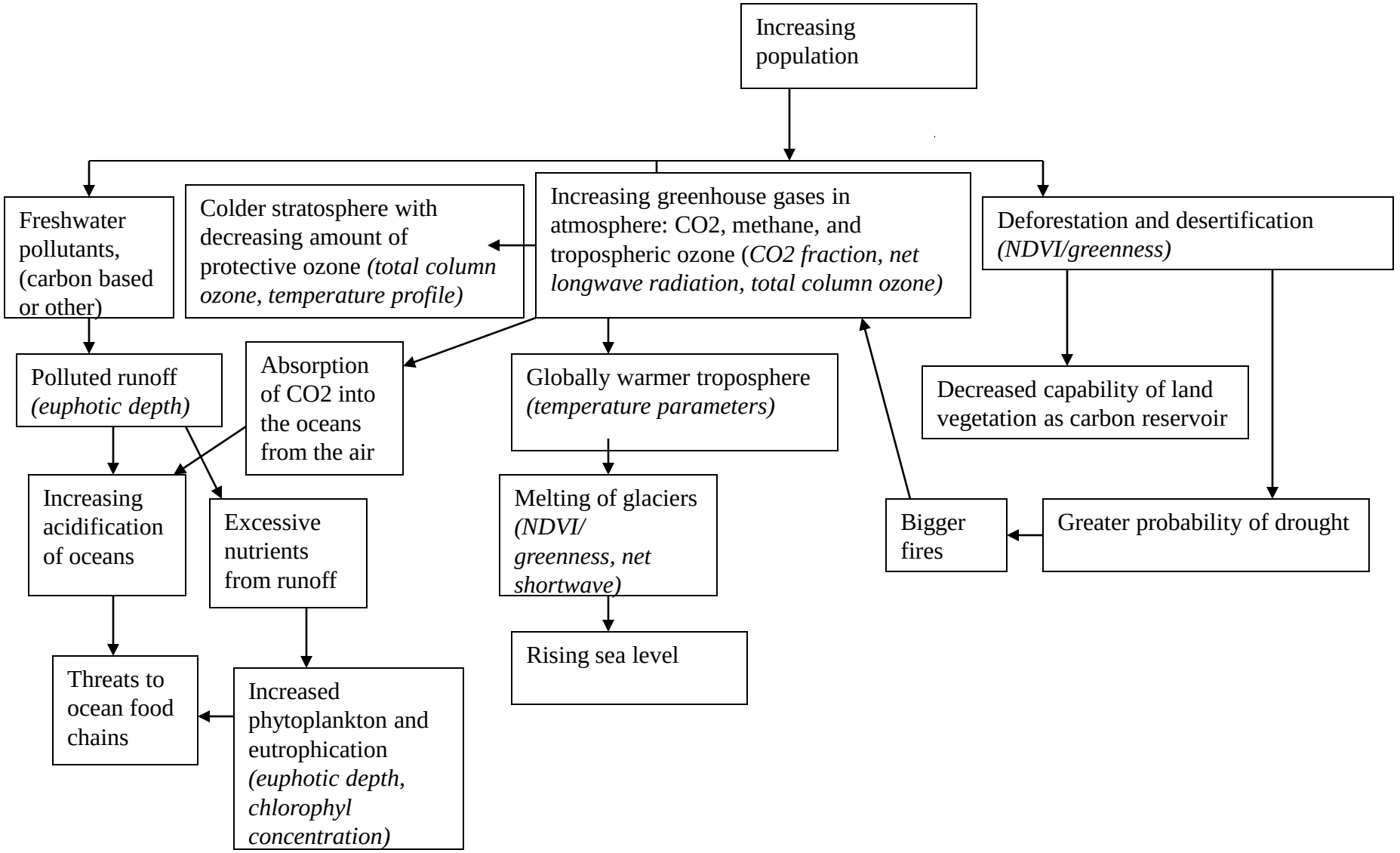
DICCE G Resources Table

DICCE Data Parameter Summary Table

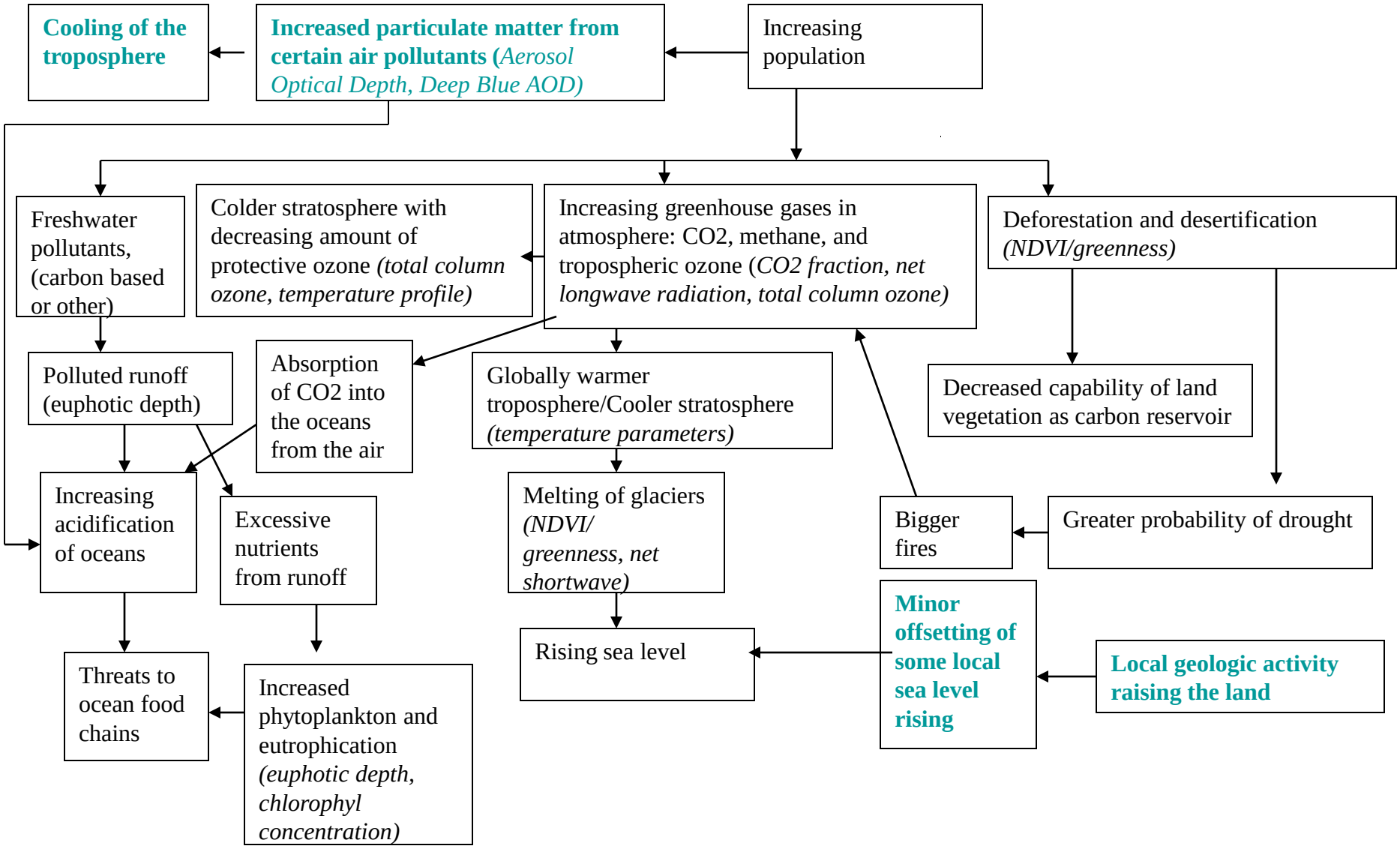
Name of data parameter	**Source of data** (remote sensing, ground station, assimilation model, other)	Measurement units	Approximate spatial resolution	Pre-defined* or dynamic** color palette	Pre-defined color palette maximum and minimum values
Euphotic depth	Remote sensing	meters	9 x 9 km	Pre-defined	0-100 log scale
Sea Surface Temperature (11 micron day)	Remote sensing	degrees C	9 x 9 km	Pre-defined	0-30
Chlorophyll a concentration (SeaWiFS)	Remote sensing	mg/m^3	9 x 9 km	Pre-defined	0-30 log scale
chlorophyll a concentration 9km (MODIS)	Remote sensing	mg/m^3	9 x 9 km	Pre-defined	0-30 log scale
Cloud Fraction (Day and Night)	Remote sensing	Unitless (ratio)	1 x 1 degree+	Pre-defined	0.0 - 1.0
Relative humidity descending (RelHumid_D) (12 Levels)	Remote sensing	Percent	1 x 1 degree+	Dynamic	**
Temperature profile descending (Temperature_D) (24 Levels)	Remote sensing	Kelvin	1 x 1 degree+	Dynamic	**
Aerosol Optical Depth at 550 nm	Remote sensing	Unitless (logarithmic value)	1 x 1 degree+	Pre-defined	0.0 - 0.9
CO2 fraction §	Remote Sensing	Parts per million	2.5 degree longitude+, 2.0 degree latitude	Dynamic	**
Deep Blue AOD at 550 nm (QA-w, Land only)	Remote sensing	Unitless (logarithmic value)	1 x 1 degree+	Pre-defined	0.0 - 0.9
Total Column Ozone	Remote sensing	Dobson Units	1 x 1 degree+	Dynamic	**
GPCP precipitation	Combined remote sensing and ground station	millimeters/day	2.5 x 2.5 degree+	Pre-defined	0-30 mm/day
Observed Ground Station Precipitation	Ground station	millimeters/hour	0.5 x 0.5 degree+	Dynamic	**
Rainfall rate	Assimilation model	kg/m^2/second	1 x 1 degree+	Dynamic	**
Net longwave radiation	Assimilation model	$Watts/m^2$	1 x 1 degree+	Dynamic	**
Net shortwave radiation	Assimilation model	$Watts/m^2$	1 x 1 degree+	Dynamic	**

http://disc.sci.gsfc.nasa.gov/giovanni/additional/users-manual/dicce_resources_page/

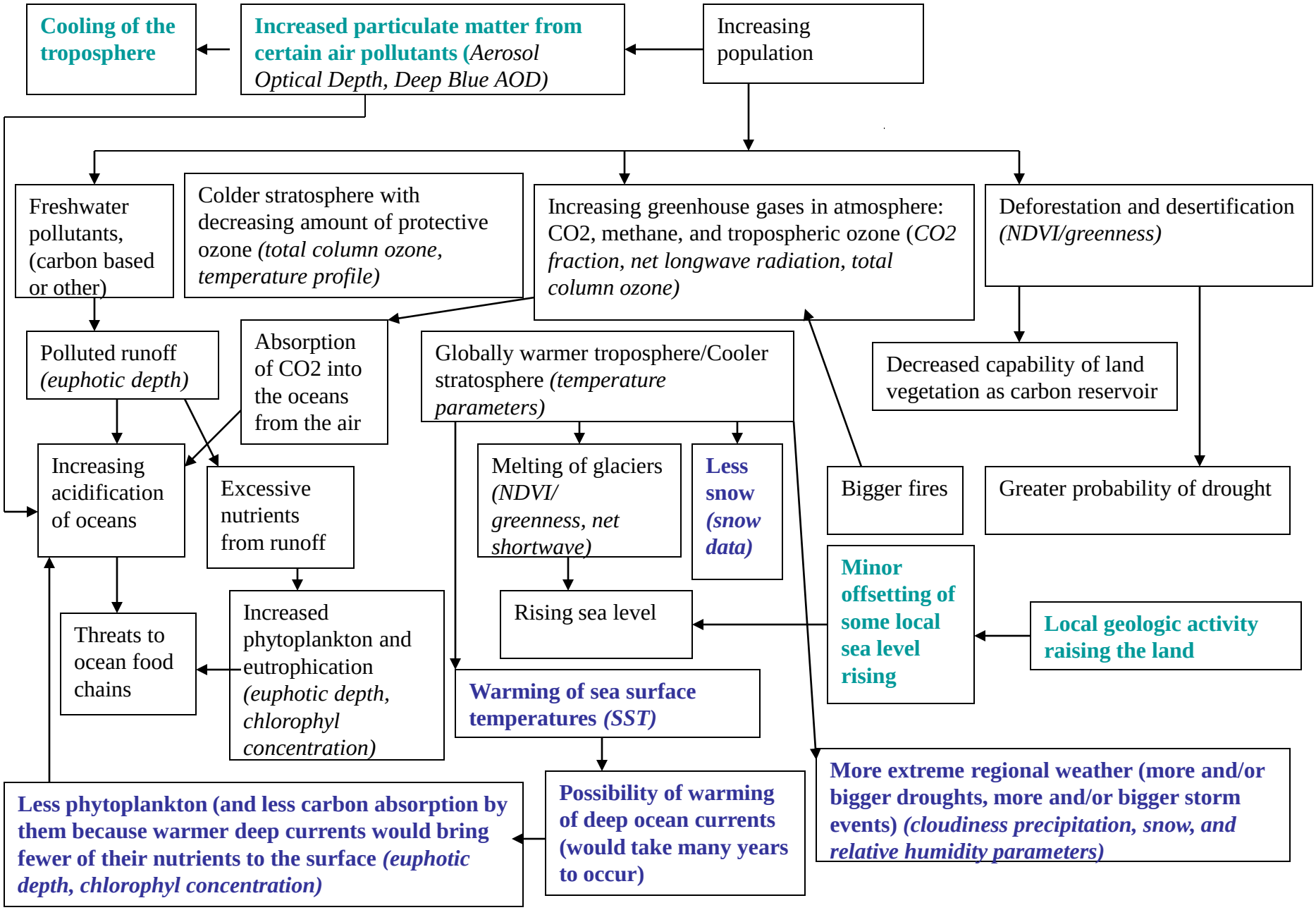
SCHEMA SLIDE 1: CERTAINTIES ABOUT RISING GREENHOUSE GASES AND THEIR GLOBAL IMPACTS

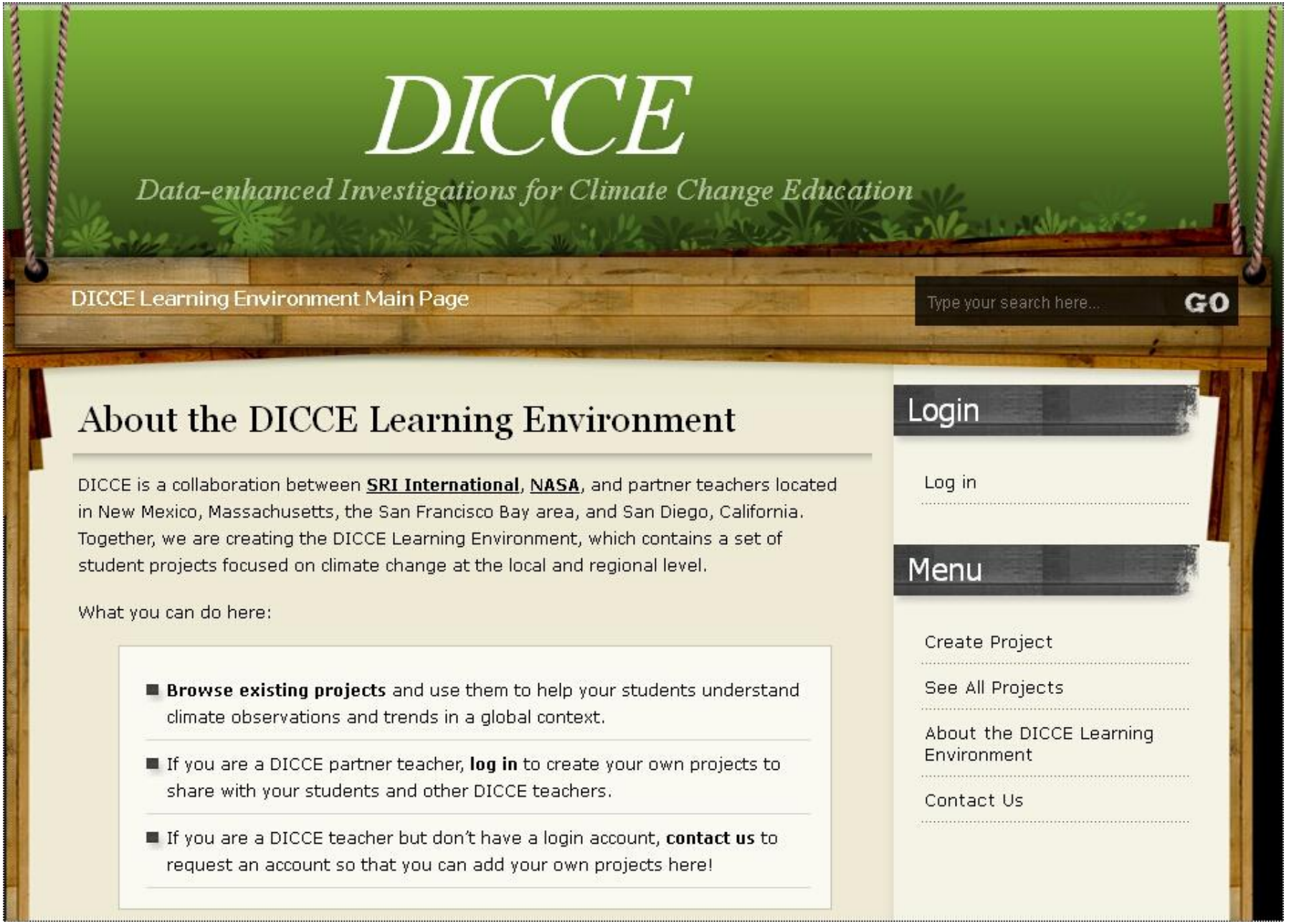


SCHEMA SLIDE 2 OVERLAY: MITIGATORS OF GLOBAL WARMING



SCHEMA SLIDE 3 OVERLAY: UNCERTAINTIES DUE TO REGIONAL PHENOMENA





dicce-le.sri.com

DICCE

Data-enhanced Investigations for Climate Change Education

Create a New Project

If you are a DICCE partner teacher, you can create your own projects to share with your students and other DICCE teachers. Once you have created your new project, you can add a trend table, various activities, and an assessment to your project.

You can create your new project from scratch, or you can copy an existing project example and edit your copy to customize it. How would you like to create your new project?

Create new project

OR

Copy an existing project and then edit it

DICCE

Data-enhanced Investigations for Climate Change Education

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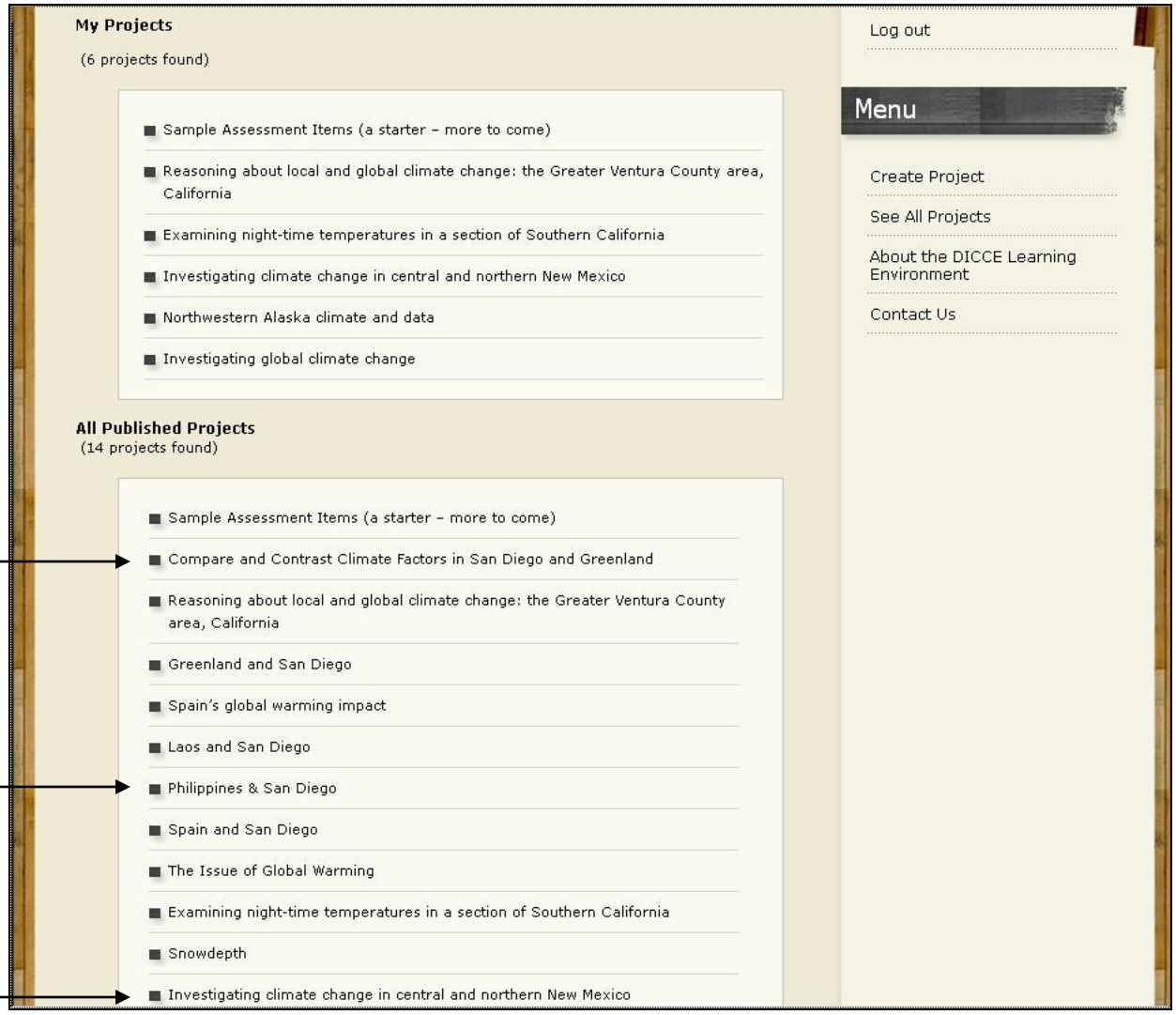
DICCE Learning Environment:
Projects list – draft and "published" versions

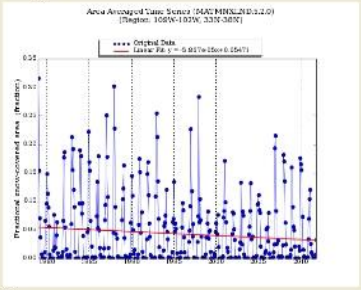
Teacher-created

Student-created

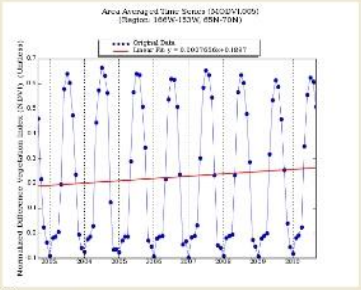
SRI-created



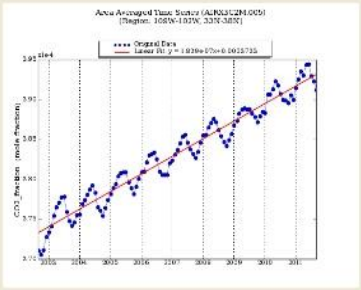
Images



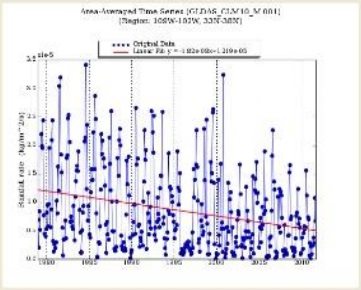
Snow cover



Greenness



CO2



Rainfall

Questions

Looking for evidence of climate change in New Mexico

Lesson	Images	Time Range	Shows Trend	Explain Your Reasoning
	Snow cover	1979-2011		
	Carbon dioxide	2003-2011		
	Greenness	2002-2011		
	Rainfall rate	1979-2011		

Help Tools Available

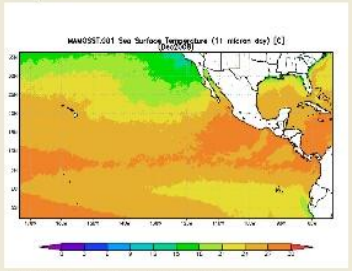
■ Map Legend Help

Plotting Sea Surface Temperatures 08-09

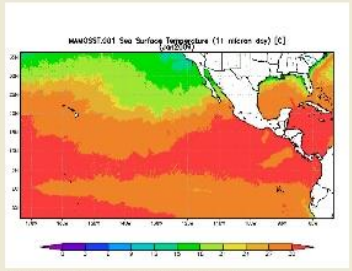
Directions

As you look at the sea surface temperature maps please develop a graph of each month; Dec, Jan, Feb, March. Then draw a straight line transect from: A. Hawaii straight Eastward B. About 3cm above previous transect C. another 3 cm above previous transect. Now take the data for each color change and plot it out on a graph with Temperature being the "y" axis and longitude being the "x" axis for each month.

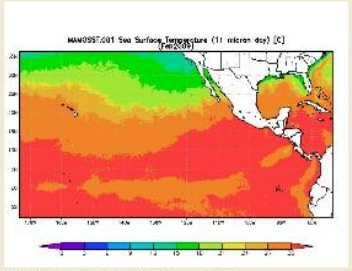
Images



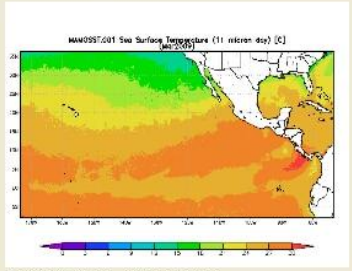
December 2008 sea surface temps



January 2009 sea surface temps



February 2009 sea surface temps



March 2009 sea surface temps

Questions

1. What is the area of significant hange from Dec 2008 to January 2009?
2. What do think caused this change?
3. What effect(s) do you think this caused on the weather?
4. What effect(s) do you think this may have caused to sea life or those whose employment depended upon sea life?

Images

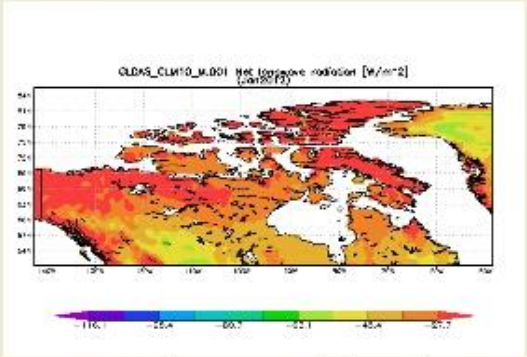


Image 1. Net longwave radiation values and the high (Northern) latitudes of North America in January 2012.

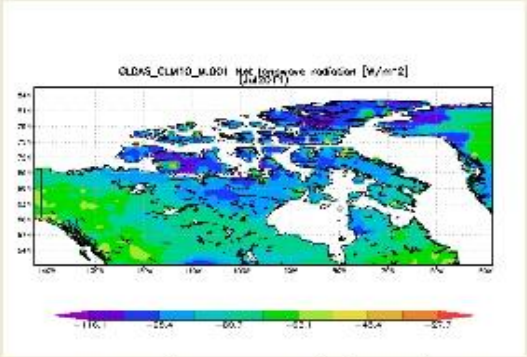


Image 2. Net longwave radiation values and the high (Northern) latitudes of North America in July 2012.

Observations

In Image 1, notice how much much of the map shows oranges and yellows (which on the legend are to the right). This means that there are all small negative values of net long wave radiation, signifying little of it in the troposphere. This makes sense because winter in the Arctic is a time when very little solar radiation reaches the surface (due to the fact that these areas have little or no daylight during the winter). Then, when this lesser amount hits the surface, there is more snow and ice on the ground to reflect it off. Hence, less of it stays on the surface to be converted to infrared radiation/heat. This keeps the atmosphere over the Arctic very cold during the winter.

In Image 2, notice how much much of the map shows purple and blue (which on the legend are to the left). This means that there are large negative values of net long wave radiation, signifying lots of it in the troposphere (at least when compared to the Arctic winter. This makes sense because summer in the Arctic is a time when there are fewer clouds in the atmosphere to block solar radiation from hitting the surface, and there are many more hours of daylight. Then, when this larger amount hits the surface, there is less snow and ice on the ground to reflect it off. Hence, more of it stays on the surface to be converted to infrared radiation/heat. This makes the Arctic atmosphere during the summer much warmer than in the winter.

Activity: Carbon dioxide map questions

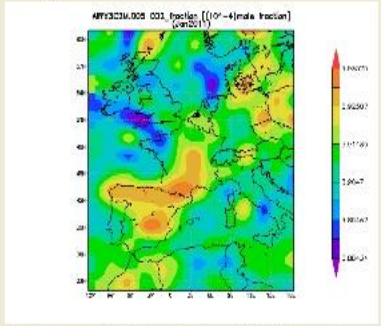
Author: Dan | Created on 26-09-2012 | Edit | Delete | Print | Submit To DICCE Archive

Return to Project Home Page: Carbon Dioxide Assessment Items

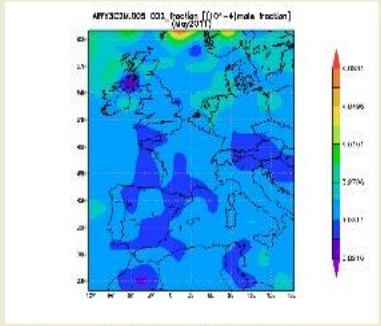
Directions

The images below indicate the amount of CO2 in the atmosphere by volume. The map is color-coded to show you numbers of of molecules of CO2 represented in a million atmospheric gas (air) molecules. Currently, the average atmospheric CO2 fraction is about 380 parts per million (or ppm) and it varies around the world by about plus or minus 5 ppm.

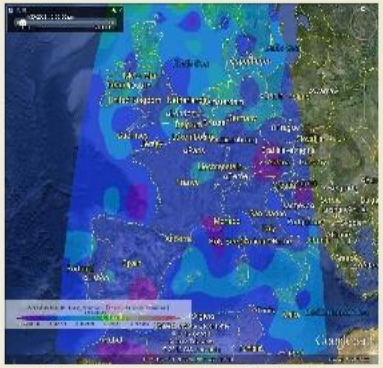
Images



1. Average daily CO2 in Jan 2011 in Western Europe and North Africa



2. Average daily CO2 in May 2011 in Western Europe and North Africa



Map 3. Same image as Map 2 but with georeferencing

1. Examine Map 1. Of the four choices, which color represents the most carbon dioxide (CO2)?
   a. blue
   b. yellow
   c. green
   d. orange

2. Examine Map 1.Which of these describes what the colors of the map show about carbon dioxide in July 2011?
   a. the total amounts
   b. the average daily amounts
   c. the percent of the area containing carbon dioxide
   d. the changes in amounts from the beginning to the end of the month

3. Examine Map 1. What quarter of the map contains the lowest levels of carbon dioxide?
   a. Southwest
   b. Northwest
   c. Southeast
   d. Northeast

4. Examine either Map 1 or 2. Why might some areas have more carbon dioxide than others? Explain your reasoning.
   a. earthquakes
   b. more daylight
   c. sunspots
   d. weather

5. Compare Maps 1 and 2. Generally speaking, what happened to the carbon dioxide levels over the mapped area between January and May?
   a. they increased
   b. they decreased
   c. they stayed about the same in most places
   d. you can't tell from the maps

6. This question is a follow up on Question 5. What is the most reasonable explanation for why?
   a. only major storms influence the amounts of carbon dioxide in the atmosphere
   b. the maps need to also show levels of oxygen before you can draw a conclusion about what happened to the carbon dioxide levels

Trend guides help teachers and students interpret DICCE G query results about change over time

DICCE Regional Trend Guide
SRI International

		Means...	Which could in turn be a sign of...	Could this trend be an effect of climate warming?	Could this trend also be contributing to more climate warming in the region?	Could this trend also be contributing to less climate warming in the region?	Other reasons for the trend?
Higher values of...	**Euphotic depth**	clearer water	less phytoplankton	Yes. We do not know for certain but global warming could be increasing ocean surface temperatures and warmer temperatures make it more difficult for nutrients from the deeper colder ocean to rise to the surface where the phytoplankton reside. Without access to these nutrients the phytoplankton cannot survive.	Phytoplankton absorb CO2 through photosynthesis, so less phytoplankton means greater amounts of carbon from the atmosphere gets dissolved in the ocean as carbonic acid, which contributes to ocean acidification (i.e., lowering of the pH level) and to the loss of marine life that come from acidification	No	
Lower values of...	**Euphotic depth**	murkier water	more phytoplankton	Unlikely	Unlikely	Unlikely	
Higher values of...	**Euphotic depth**	clearer water	less run-off into the ocean of water containing pollutants or thick sediments	Yes, if the decrease in runoff is due to a sustained drought, and the drought is occuring over so many years that it suggests true climate change from global warming is occuring	Unlikely	Unlikely	Successful efforts by people to restore greater vegetation to the land or natural floodplains could lead to less runoff into the ocean. Yet less runoff could also be caused by droughts that may be due to other factors besides global warming (such as poor soil management by people, or the effects of periodic shifts in winds and sea surface temperatures known as the oscillations (for example, annual El Nino and La Nina "events")
Lower values of...	**Euphotic depth**	murkier water	more run-off into the ocean of water containing pollutants or thick sediments	Indirectly. Long-term trends of increased runoff could be a sign of a wetter climate or caused by sustained melting of glaciers that feed the watershed	Unlikely	Unlikely	Increasing runoff could be the result of humans clearing the land of vegetation, which would cause greater amounts of runoff when there is precipitation. If the vegetation is being replaced by urban development, the runoff may include increasing amounts of pollution that seeps into the runoff from cars, factories, and other human sources
Higher values of...	**Sea Surface Temperature**	warmer water at the surface		Yes. This could be a sign of warmer air in the atmosphere heating up the ocean surface.	Unlikely	Unlikely	Annual oscillation-induced events such as El Nino or La Nina

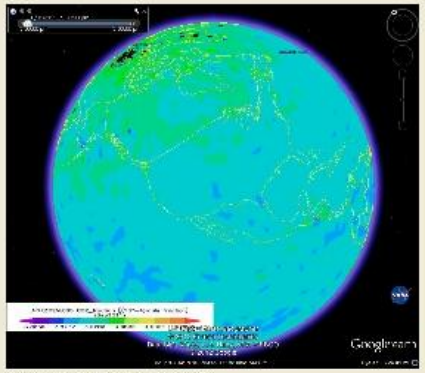
DICCE Learning Environment: Additional supports teachers can make available to their students

Global carbon dioxide in Sept 2011

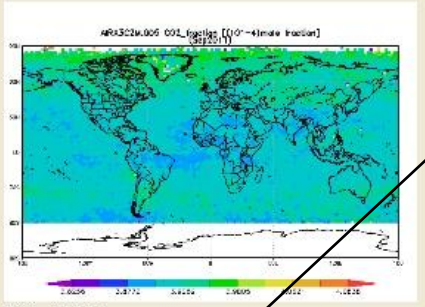
Directions

These images show levels of carbon dioxide (CO2) in September 2011.

Images



CO2 over North America



Global CO2

Questions

1. Do you see a relationship between the amount of carbon dioxide in the troposhere and geographical location? If so, what relationship do you see, and how do you explain the relationship?

Help Tools Available

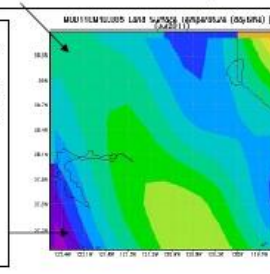
- Map Legend Help
- Time Series Help
- Vertical Profile Help

HOW TO INTERPRET A DICCE MAP

A DICCE map shows a geographical area that has been colored or shaded to show the range of values across the area for a certain set of data. Below are two images about the average daytime land surface temperatures in an area of California stretching from the Pacific Ocean on the west through the Sierra Nevada Mountains and into Nevada on the east. Map 1 below shows the average values in this area for one month, July 2001. The data were collected daily, then averaged.

In this Central California area (shaded in pale green), the average daytime temperature in July 2011 was between 311.2 and 313.4° Kelvin (i.e. 100.8 to 104.7° Fahrenheit)

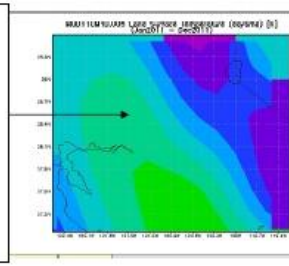
Along this small section of the California coast (shaded in dark purple) the average daytime temperature in July 2011 was between 298 and 300.2° Kelvin (i.e. 77 to 81° Fahrenheit)



The legend shows what values each color represents

Map 2 below shows the same area but over a whole year. Each color-represented value *is the average of all of the monthly temperatures*. Each value was calculated by taking the total degrees of all 12 months in the year divided by 12.

In this Central California area (shaded in pale green), the average daytime temperature across all 12 months in 2011 was between 300.2 and 302.4° Kelvin (i.e. 80.7 to 84.9° Fahrenheit)



This section of the legend indicates what range of values pale green represents on the map.

DICCE Access

- Querying DICCE G and saving the data and visualizations (open to all users)
- Using existing curriculum exemplars and assessment items (open to all users)
- DICCE LE Curriculum Authoring Privileges (open to DICCE grant-funded participants)
- DICCE Professional Development (open to DICCE grant-funded participants)

DICCE Learning Curve

- DICCE teachers trained in one-day sessions, one-on-one with trainer
- DICCE Face to Face group professional development has been effective
- DICCE LE is proving easy to master
- In a usability test, two teacher trainers from a district office mastered DICCE G and DICCE LE in one evening, independently, with just DICCE G how-to videos and a DICCE LE how-to slide show tutorial). By the end of the evening, they could do a DICCE G query, import the images into DICCE LE and construct a curriculum activity around the images.

Results from DICCE Summer Camp at CSU Channel Islands

DICCE Oxnard Student Feedback Summer Camp (June 25-26, 2012) - 40 student participants

1. Did you learn something new about science from this activity? **93% said yes**

2. Was the activity fun to do? **60% said yes**

3. Did this activity make you more interested in science? **63% said yes**

Web sites

- To DICCE-Giovanni monthly data: http://gdata1-ts1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=DICCE-G_Basic
- To DICCE-Giovanni daily data: http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=DICCE-G_Daily
- To DICCE Learning Environment: http://dicce.sri.com/wp/

Check back in two weeks for access to master umbrella DICCE web site:

dicce.sri.com

Contact

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